

AD-A202 930 TIC LECTE TO SECLASEIFICATION/DOWNGRAM PACEFUL AS A PROGRAMMO ORGANIZATION TO PROTECT THE STATE OF THE PROGRAMMO ORGANIZATION TO PROTECT THE STATE OF THE PROGRAMMO ORGANIZATION TO PROTECT THE PROGRAMMO ORGANIZATION TO PROTECT THE PROGRAMMO ORGANIZATION ORGANIZATION TO PROGRAMMO ORGANIZATION ORGANIZATION TO PROGRAMMO ORGANIZATION	_				REPORT DOCUME	NTATION PAGE	E 7	770 ELLE	CODY
DECLASSIFICATION/DOWNGRA GENERAL SETTING TO THE STATE OF SECOND TO T	AD.	-A2()2 9	930 5	TIC	15. RESTRICTIVE M	ARKINGS	Hit HEE	LUE
Approved for public selease; Approved for public selease; As a mame of performing organization and mymmeris) A mame of performing organization and mymmeris Cambridge, MA 02138 B. Office for Sponsored Research AFOSR 17. Name and 217 Code; Office for Sponsored Research AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); B. MADRESS (City, Stem and 217 Code); B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 B. ADDRESS (City, Stem and 217 Code); AFOSR 85-0076 AFOSR 85-0076 AFOSR 85-0076 AFOSR 85-00	_			_		3. DISTRIBUTION/A	VAILABILITY O	FREPORT	
APORES CIO, Sales and ZIF Code; B. ADMITCHING APORT TRUE TO SUBSTITUTE OF REPORT IV. Mo. Day) 12. PREFORMING ORGANIZATION A OFFICE SYMBOL (A NAME OF MONITORING ORGANIZATION A PROPERTY OFFICE SYMBOL (A NAME OF MONITORING ORGANIZATION A PROPERTY OFFICE SYMBOL (A NAME OF MONITORING ORGANIZATION A NAME OF MONITORING ORGANIZATION A NAME OF MONITORING ORGANIZATION A PROPERTY OFFI A NAME OF MONITORING ORGANIZATION A PROPERTY OFFI AND A NAME OF MONITORING ORGANIZATION A PROPERTY OF MAN AND PROPERTY ORGANIZATION ORGANIZATION (A PROPERTY ORGANIZATION) B. AASTOR OF CHURIOROGAPONO (A PROPERTY ORGANIZATION) B. ADORESS CIO, Sales and ZIF Code; B. ADORES CIO, Sales and ZIF Code; B. ADORES CIO, Sales and ZIF Code; B. ADORESS CIO, Sales and ZIF Code;	TO CECLAS	RIFICATION	DOWNGR			Approved	for publ	ic melease	· ,
AFORR-TR. 88-1322 6a. NAME OF FERFORMING ORGANIZATION RAPPLESSYMBOL MAJOR FERFORMING ORGANIZATION RETAINS COLORS 6b. ADDRESS (City, State and ZIF Code) C. ADDRESS (City, State and ZIF Code) APOSR 85-0076 C. ADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, Washington, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, Washington, DC 20332 C. PADDRESS (City, State and ZIF Code) Building APB, Washington, DC 20332 C. PADRESS (City, State and ZIF Code) Building APB, Washington, DC 20332 C. PADRESS (City, State and ZIF Code) Building APB, Washington, DC 20332 C. PADRESS (City, State and ZIF Code) Building APB, Washington, DC 20332 C. PADRESS (City, State and ZIF Code) Building APB, Washington, DC 20332 C. PADRESS (City, State a	20. DECEM	MITTER TOO	J J J J J J J J J J J J J J J J J J J	DE	C1 6 1988				
Sea NAME OF PERFORMING ORGANIZATION Harvard College Deservatory Harvard University Deservatory Sec. ADDRESS (City, State and ZIP Code) Office for Sponsored Research Cambridge, MA 02138 Sea NAME OF FUNDING/SPONSORING ORGANIZATION AFOSR Sea NAME OF FUNDING/SPONSORING ORGANIZATION Sea NAME OF FUNDING/SPONSORING ORGANIZATION AFOSR Sea NAME OF FUNDING/SPONSORING ORGANIZATION AFOSR Sea NAME OF FUNDING/SPONSORING AFOR SECURITY AFOR ORGANIZATION Sea NAME OF FUNDING/SPONSORING AFOR SECURITY COMMAND AFOR SECURITY AFOR ORGANIZATION Sea NAME OF FUNDING/SPONSORING AFOR SECURITY COMMAND AFOR SECURITY AFOR SECURITY ORGANIZATION AFOR SECURITY ORGANIZATION 10. OFFICE SYMBOL (I/ 2007 SEA NAME OF MEDITY OR AFOR ORGANIZATION 112. FUNDING/SPONSORING ORGANIZATION 113. TYPE OF REPORT SEA SUPPLEMENTARY NOTATION 114. DATE OF REPORT (IV. No. Day) 115. PAGE COUNT 115. SUPPLEMENTARY NOTATION 116. PAGE COUNT 117. COSATI CODES 118. DATE OF REPORT (IV. No. Day) 118. PAGE COUNT 119. ABSTRACT (CONSISSA ORGANIZATION 119. ABSTRACT (CONSISSA ORGANIZATION 119. ABSTRACT (CONSISSA ORGANIZATION 119. ABSTRACT (CONSISSA ORGANIZATION 110. ORGANIZATION 110. ORGANIZATION 110. ORGANIZATION 110. ORGANIZATION 110. ORGANIZATION 110. ORGANIZATION 111. ORGANIZATION 112. ABSTRACT (CONSISSA ORGANIZATION 113. TYPE OF REPORT (IV. No. Day) 114. DATE OF REPORT (IV. No. Day) 115. PAGE COUNT 115. PAGE COUNT 116. PAGE COUNT 117. ORGANIZATION 118. DATE OF REPORT (IV. No. Day) 118. PAGE COUNT 119. ORGANIZATION 119. ABSTRACT (CONSISSA ORGANIZATION 110. ORGANIZATION 1	4. PERFORI	MING ORGAN	IZATION	O NUM	BER(S)	5. MONITORING OR	GANIZATION RE	EPORT NUMBERIS	
Harvard University Rarvard University Air Force Office of Scientific Research Rarvard University Rarvard College Research Rarvard University Research Research					Da	AFOS	R-TR- 8	8 - 1 32	2
Air Force Office of Scientific Research Harvard University 6. ADDRESS (City, State and ZIF Code) Air Force Systems Command, USAF Cambridge, MA 02138 6. ADDRESS (City, State and ZIF Code) AFOSR 6. ADDRESS (City, State and ZIF Code) Building 410 Building 410 Building 410 Building 410 C. Papaliolios 7. ADDRESS (City, State and ZIF Code) Building 4FB, DC 20332 11. TITLE (Includes Security Classification) C. Papaliolios 12. FERSONAL AUTHORIS) C. Papaliolios 13. TYME OF REFORT Final C. COSATI CODES FIELD GROUP SUB. GR. ABSTRACT (Continue on recomment of the property of the continue on recomment of the property of the continue on recomment of the property of the continue on recommendation of the property		_		NIZATION					
See ADDRESS (City, State and ZIF Code) The Porce Systems Command, USAP				Observa		Air Force	Office of	Scientifi	c Researc
Office for Sponsored Research Cambridge, MA 02138 8. NAME OF FUNDINGSPONSORING ORGANIZATION AFOSR 85-0076 8. ADDRESS (CIT), Sizes and 217 Code; Building 410 Building 410 Building 410 Building AFB, DC 20332 11. TITLE (Include Security Clessification) University Research Instrumentation Upgrade 12. PREGNAL AUTHORS: C. Papaliolios C. Papaliolios C. Papaliolios C. Papaliolios C. Papaliolios 13. SUBJECT TERMS (Continue on mucro in sections) FROM Includes The first objective will be operiors partial, low order wavefront correction to a series of incoming distorted wavefronts will be measured with the newly acquired wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefronts will be done with a dors process in the secondary continues, was will then apply our well developed specific correction to the wavefronts will be reconstructed images. The first objective will be to the vavefront will be done with the care partial correction to the wavefront will be reconstructed images. The first objective will be never to the vary in time. The distortion of these incoming wavefronts will developed specific to reserve the improvement of the vary in time. The distortion of the wavefront will be done with the correction to a series of incoming distorted wavefronts will be measured with the newly acquired wavefront partial, low corrected wavefronts and measure the improvement in the time in the constituted images. This will be done under controlled laboratory conditions, fusing a photon counting camera, also acquired under this grant. We expect to characterizesthis combined process of adaptive optics and specific imaging to combined process of adaptive optics and specific imaging to combined process of adaptive optics and specific imaging to combined process of adaptive optics and specific imaging to combined the process of adaptive optics and specific imaging to combine done several years acquired to the process of adaptive optics and specific imaging to combine				ty		The ADDRESS (CIA)	State and 7/8 Co.		
Solling AFB, Washington, DC 20332 So. NAME OF FUNDING/SPONSORING ORGANIZATION AFOSR So. ADDRESS (CIP, Stem and ZIP Code) Building 410 Bo. OFFICE SYMBOL (If Springwale) Bo. OFFICE SYMBOL					esearch	• •			AF
AROUNT OF FUNDING/SPONSORING ORGANIZATION AFOSR 8. ADDRESS (City, State and ZIP Code) Building 410 Building 410 Building APB, DC 20332 10. SOURCE OF FUNDING MOS. PROGRAM PROJECT TASK WORK UNIT MO. (10.0 C) 11. TITLE (Include Security Classification) University Research Instrumentation Upgrade 29/0 A6 12. PERSONAL AUTHORIS) 13. TIME COVERED FUNDING MOS. PROGRAM 13. TIME COVERED FUNDING MOS. 14. DATE OF REPORT (No. Day) 15. SUPPLEMENTARY NOTATION 17. COSATI CODES 18. SUBJECT TERMS (Continue on reware if necessary and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block number) 19. ASSTRACT (Continue on reware infraccessory and identify by block numbe			_			8	_		
AFOSR 85-0076 R. ADDRESS (City, Sinte and ZIP Code) Building 410 Bolling AFB, DC 20332 TI. TITLE (Include Security Chesification) University Research Instrumentation Upgrade C. Papaliolios 13. TYPE OF REPORT Final TI. SUPPLEMENTARY NOTATION TI. COSATI CODES FIELD GROUP 13. ABSTRACT (Continue on reverse Muncassary and identify by Nock number) Under-this grant we have developed and equipped a new optics adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse Muncassary and identify by Nock number) Under-this grant we have developed and equipped a new optics adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse Muncassary and identify by Nock number) Under-this grant we have developed and equipped a new optics adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse Muncassary and identify by Nock number) Under-this grant we have developed and equipped a new optics adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse Muncassary and identify by Nock number) Under-this grant we have developed and equipped a new optics adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse Muncassary and identify by Nock number) Under-this grant we have developed and equipped a new optics adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse Muncassary and identify by Nock number) Under-this grant we have developed and equipped a new optics adaptive optics; speckle imaging adaptive optics; speckle imaging vavefronts that vary in time. The distortion of these incoming overested wavefronts will be to perform partial, low order partial correction to the wavefronts will have optically out to a series of incoming distorted wavefront will have optically out to a series of incoming distorted wavefront will have optically out to a series of incoming distorted wavefront will have optically out to a series of incoming on the series of i								·	•
AFOSR 85-0076 Be Adores (Cir, Sine and ZIF Code) Building 410 Bolling AFB, DC 20332 C. Papaliolios 13. TITLE (Includes Security Cinetification) University Research Instrumentation Upgrade 2917 AC 11. TITLE (Includes Security Cinetification) University Research Instrumentation Upgrade 2917 AC 12. FERSONAL AUTHORIS) C. Papaliolios 13. TYPE OF REPORT 13. TIME COVERED FINAL FROM 1/1/85 TO 6/30/87 14. DATE OF REPORT (Instrumentation) 17. COSATI CODES FIRED GROUP 18. SUBJECT TERMS (Continue on numbers if necessary and identify by block numbers) 19. ABSTRACT (Continue on numbers white cases, and density and identify by block numbers) 19. ABSTRACT (Continue on numbers white cases, and density and identify by block numbers) 19. ABSTRACT (Continue on numbers white cases, and identify by block numbers) 19. ABSTRACT (Continue on numbers white cases, and identify by block numbers) 19. ABSTRACT (Continue on numbers white cases, and identify by block numbers) 19. ABSTRACT (Continue on numbers white cases, and identify by block numbers) 19. ABSTRACT (Continue on numbers white cases, and identify by block numbers) 19. ABSTRACT (Continue on numbers of instrumentation of partial low confer wavefronts that vary into a series of incoming distorted wavefronts that vary into a series of incoming distorted wavefronts that vary into a series of incoming distorted wavefronts that vary into a series of incoming distorted wavefronts will be measured with the distortion of these incoming wavefronts will be measured with the distortion of these incoming wavefronts wavefronts and sepache and partial distortion of these incoming wavefronts wavefronts and sepache into the partial partially corrected wavefronts and measure the improvement in the reconstructed insection of controlled laboratory conditions, was ing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging, to determine whether it is a useful means of producing high			SPONSORI	NG		9. PROCUREMENT	INSTRUMENT ID	ENTIFICATION NU	IMBER
Be ADDRESS (Cip. State and ZIP Code) Building 410 Building 410 Building AFB, DC 20332 II. TITLE (Include Security Classification) University Research Instrumentation Upgrade 12. PERSONAL AUTHORIS C. Papaliolios 13a TYPE OF REPORT Instrumentation 15a TIME COVERED FROM 1/1/85 TO 6/30/87 5/27/88 16. PAGE COUNT 17a COSATI CODES III. SUPPLEMENTARY NOTATION 15. ASSTRACT (Continue on rewere Numerosary and identify by Mock number) Under this grant we have developed and equipped a new optics 15a Instrumental correction to a series of incoming distorted wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. Ne will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed inages. This will be done under controlled laboratory conditions, susing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed inages. This will be done under controlled laboratory conditions, susing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging to determine whether it is a useful means of producing high resolutions of suscess based on calculations done several years 20. DISTRIBUTION/AVAILABILITY OF ASTRACT UNCLASSIFIED/UNLIMITED A SAME AS APT. [OTIC USERS [] 12. ASSTRACT SECURITY CLASSIFICATION UNCLASSIFIED/UNLIMITED A SAME AS APT. [] OTIC USERS [] 12. ASSTRACT SECURITY CLASSIFICATION UNCLASSIFIED/UNLIMITED A SAME AS APT. [] OTIC USERS [] 12. ASSTRACT SECURITY CLASSIFICATION UNCLASSIFIED/UNLIMITED A SAME AS APT. [] OTIC USERS [] 12. ASSTRACT SECURITY CLASSIFICATION UNCLASSIFIED/UNLIMITED A SAM					(If applicable)	AFOSR	85-0076		
Building 410 Bolling AFB, DC 20332 PROGRAM PROJECT YASK WORK UNIT					1)7				
Bolling AFB, DC 20332 Color Color		•		ode)					
11. TITLE (Include Security Classification) University Research Instrumentation Upgrade 2910 A6 12. PERSONAL AUTHORIS C. Papaliolios 13a. TIME COVERED FROMT Final FROM 1/1/85 TO 6/30/87 5/27/88 15. PAGE COUNT Final FROM 1/1/85 TO 6/30/87 5/27/88 15. PAGE COUNT Final FROM 1/1/85 TO 6/30/87 5/27/88 15. PAGE COUNT Final ROUTE SUBJECT TERMS (Continue on reverse if necessary and identify by block number) 17. COSATI CODES 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) 18. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 19. ASSTRACT (Continue on reverse Nuncessary and identify by block number) 20. OISTRIBUTION/AVAILABILITY OF ASSTRACT 21. ASSTRACT SECURITY CLASSIFICATION 22. OFFICE SYMBOL 22. OFFICE SYMBOL 22. OFFICE SYMBOL 22. OFFICE SYMBOL 23. ANAME OF RESPONSIBLE INDIVIDUAL 23. ANAME OF RESPONSIBLE INDIVIDUAL 24. ANAME OF RESPONSIBLE INDIVIDUAL				C 20333					
13. TITE (Include Security Classification) University Research Instrumentation Upgrade 12. PERSONAL AUTHORIS) C. Papaliolios 13a TYPE OF REPORT Final 15. TIME COVERED FROM 1/1/85 TO 6/30/87 5/27/88 15. SUPPLEMENTARY NOTATION 17. COSATI CODES 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) 17. COSATI CODES 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse threecessary and identify-by-block number) 19. ASSTRACT (Continue on reverse three continue on reverse if necessary and identify by block number) 19. ASSTRACT (Continue on reverse three continue on reverse if necessary and identify by block number) 20. ASSTRACT (Continue on reverse three continue on reverse if necessary and identify by block number) 21. ASSTRACT (Continue on reverse three continue on reverse if necessary and identify by block number) 22. OISTRIBUTION/AVAILABILITY OF ASSTRACT 22. OFFICE SYMBOL (Include Area Code) 22. OFFICE SYMBOL (Include Area Code) 22. OFFICE SYMBOL (Include Area Code)		illing r	LEB, D	C 20332		/ 1102 F	}		
13. TYPE OF REPORT Final 13b. Time COVERED FROM 1/1/85 TO 6/30/87 5/27/88 15. PAGE COUNT Final 17. COSATI CODES 18. SUBJECT TERMS (Continue on reverse if necessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 19. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 20. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 21. ABSTRACT (Continue on reverse threcessary and identify by Mock number) 22. Distribution/AVAILABILITY OF ABSTRACT 22. ABSTRACT SECURITY CLASSIFICATION 23. ABSTRACT SECURITY CLASSIFICATION 24. ABSTRACT SECURITY CLASSIFICATION 25. OFFICE SYMBOL (Included AMS Code) 26. OFFICE SYMBOL (Included AMS Code) 27. ABSTRACT SECURITY CLASSIFICATION 28. ABAME OF RESPONSIBLE INDIVIDUAL 27. ABSTRACT SECURITY CLASSIFICATION 28. ABAME OF RESPONSIBLE INDIVIDUAL 28. ABAME OF RESPONSIBLE INDIVIDUAL	11. TITLE	Include Securi	ty Classifica	tion)		1 - '] _] .	
C. Papaliolios 13a TYPE OF REPORT Final 13b. Time COVERED Final 15b. Time COVERED FROM 1/1/85 TO 6/30/87 5/27/88 16. SUPPLEMENTARY NOTATION 17. COSATI CODES 18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRACT (Continue on reverse in necessary and identify by block number) 19. ABSTRA	Unive	rsity F	Resear	ch Inst	rumentation Up	grade	2912	A6	
18. SUPPLEMENTARY NOTATION 18. SUPPLEMENTARY NOTATION 19. COSATI CODES 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 19. ASSTRACT (Continue on reverse Muncressary and identify by block number) 20. ASSTRACT (Continue on reverse Muncressary and identify by block number) 21. ASSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT (Continue on reverse Muncressary and identify by block number) 22. ABSTRACT SECURITY CLASSIFICATION 22. ABST	12. PERSON	IAL AUTHOR		Papali	olios				
17. COSATI CODES 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse threcessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and identify by block number) 19. ABSTRACT (Continue on reverse if necessary and equipment of the second incoming description of these incoming description of these incoming description of t		F REPORT		_					TNUO
17. COSATI CODES SUBJECT TERMS (Continue on reverse if necessary and identify by block number) Adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse innecessary and identify by block number) Under this grant we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, wasing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging, to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. Our expectations of success based on calculations done several years ago are quite high. 20. DISTRIBUTION/AVAILABILITY OF ASSTRACT				FROM 1/	1/85 to 6/30/	5/2//	88		
adaptive optics; speckle imaging 19. ABSTRACT (Continue on reverse Management and identify by Mock number) Under this grant we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, wusing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging, to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. Our expectations of success based on calculations done several years 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED SAME AS RPT. DICCUSERS Unclassified 22a. NAME OF RESPONSIBLE INDIVIDUAL Henry Radoski Adaptive optics; speckle imaging to adaptive optics and equipped a new optics the new optics and equipped a new optics the new optics the new optics the management of these incoming the process of incoming distorted to the several process and p	ie. Supple	MENIARYN	UIAIION		-				
19. ABSTRACT (Continue on reverse Muscessary and identify-by-block number) Under-this grant/we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, wusing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging, to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. Our expectations of success based on calculations done several years ago are quite high. 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ASAME AS RPT. DICCUSERS D Unclassified 22a. NAME OF RESPONSIBLE INDIVIDUAL Henry Radoski Adaptive optics number Unclassified 22b. TELEPHONE NUMBER (Include Ame Code) (20c) 767-4706 WF	17.	COSATI	CODES		18. SUBJECT TERMS (C	ontinue on reverse if n	ecessary and ident	ify by block number	,
19. ABSTRACT (Continue on morres in necessary and identify by Nices number) Under this grant we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, using a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. Our expectations of success based on calculations done several years ago are quite high. 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED A SAME AS RPT. DICCUSERS UNclassified Unclassified 22b. TELEPHONE NUMBER (Include Area Code) (JOR) 767-4906 WP	FIELD	GROUP	SU	98. GR.]				
Under this grant we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, fusing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. Our expectations of success based on calculations done several years ago are quite high. 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNILIMITED SAME AS APT. DITIC USERS UNCLASSIFIED/UNILIMITED SAME AS APT. DITIC USERS UNCLASSIFIED/UNILIMITED SAME AS APT. DITIC USERS UNCLASSIFIED/UNILIMITED ASAME AS APT. DITIC USERS APT. Out of the control of the		<u> </u>			adaptiv	e optics; s	peckle im	aging	
Under this grant we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, fusing a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. Our expectations of success based on calculations done several years ago are quite high. 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNILIMITED SAME AS APT. DITIC USERS UNCLASSIFIED/UNILIMITED SAME AS APT. DITIC USERS UNCLASSIFIED/UNILIMITED SAME AS APT. DITIC USERS UNCLASSIFIED/UNILIMITED ASAME AS APT. DITIC USERS APT. Out of the control of the	10 40570	CT (Cartions		M	A / day Way buy black or buy				
Henry Radoski (202) 767-4906 NP	20. DISTRIE	la te or wa wa se be ap co re la ac de re ex ag	Under b for 1 chnique der wav vefront vefront nsor, a done w ply our rrected construt borator quired mbined termine solution pectation are quired solution are quired	aboratory s. The firefront constant was will be not low ordith a few well deve wavefront cted images of whether in images wons of sucuite high.	ant we have development we have development with the creation to a sering the control of the con	oped and equipped of adaptive it be to perform the performing of incoming the newly acquired the elements. It characters to characters and speckle in the gathering of culations done and counting can be considered to characters and speckle in the gathering of culations done and c	optics rm partial, g distorted these incomi these incomi avefronts wi We will then ese partiall in the era, also rize; this maging, to mg high conditions. e several ye URITY CLASSIFI sified	low ng 11 y Our ars	
Henry Radoski (202) 767-4906 NF	334 NAME	OF RESPONS	IBLE INDI	VIDUAL				22c. OFFICE SYM	BOL
								NP	المستندين المستندين المستندين

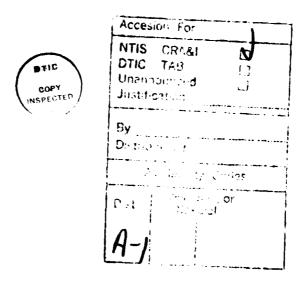
SECURITY CLASSIFICATION OF THIS PAGE

Under this grant we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, using a photon counting camera also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. expectations of success based on calculations done several years ago are quite high.

The reason for combining the two techniques of image improvement (adaptive optics, and speckle imaging) is to enable us to push the imaging capabilities towards objects that are more complex, and fainter than objects currently observed. Adaptive optics techniques have been successfully demonstrated many years ago, but only for objects that are quite bright. Speckle imaging has extended the magnitude limits substantially but a further improvement is still needed to study those objects of greatest astronomical interest.

The path leading to this capability has been slow and sometimes painful, but the progress has been real and further important improvements are now within reach. Many of the problems in getting here come from the fact that state-of-the-art sensors and detectors are required. Now that we have the lab in place, we can begin to answer some of the questions we raised several years ago.

In anticipation of success with the laboratory measurements, the system we will assemble will be portable. This will enable us to test the final system on a telescope with real data, but this step will be taken only after laboratory characterization of the process is performed.



AFOSR-85-0076	
LIST	
EQUIPMENT	
000	

ITEM	VENDOR	Original			Amount Date	e Outstanding
WAVEFRONT SENSOR	WAVEFRONT SENSOR ADAPTIVE OPTICS;	\$83,000	\$108,000	S44780	72,000 10/86	86 36,000
& UPGRADE	DIGITAL EQUIPMENT	30,000	5,033 15,363	S32469 S32468	5,033 11/ 15,363 8/8	85 5
& UPGRADE	ADAPTIVE OPTICS		0,0	S44780-1		20,00
Subtotal		\$113,000	8,3	ı	\$95,396	\$86,000
PHOTON COUNTING CAMERA	ADAPTIVE OPTICS	27,0	34,000	S44782		34,00
TAPE DRIVE	S&S ELECTRONICS	5,500	5,955	S51113	5,955 12/	/85
OPTICAL COM- PONENTS	PLANAR OPTICS JAEGERS	4,900	1,402	R69907 T56268	1,402 3/8	7
OSCILLOSCOPE	HITACHI	1,300	1,868	90168-DA	1,868 1/86	9
OPTICAL TABLE SYSTECHNICAL	STECHNICAL MANUFACTURING	10,650	5,695	T51231	5,695 1/87	7
MOUNT HARDWARE	KLINGER	8,350	6,642	T56267	6,642 1/87	7
STAGES & MOUNTS	PHYSITEC NEWPORT	6,200	548	T56269 T56270	548 1/87	7:3/87
MOTORIZED ACTUATORS (4)	ORS (4)	8,250	•		; ;	
UPTICAL BREAUBUR LASERS(2)	UNIPHASE	1,450	89	T56271	8/1 689	7
ORS	& BURLEIGH	5,550	4,46	T64023	m	7
HALOGEN LAMP		850				
AKC LAMP		1,500				
I.VEM DEFORMABLE MIRROR	MIRROR	40.000				
STABILIZED LASER		. •]	0		! ! !	
TOTAL TO DATE		249,4			, 504	0